

**2009-2010
ANNUAL HABITAT WORK PLAN**



PARKER RIVER NATIONAL WILDLIFE REFUGE

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Parker River National Wildlife Refuge was established in 1942 primarily to provide feeding, resting and nesting habitat for migratory birds. The Refuge consists of 4,662 acres of diverse upland and wetland habitats including sandy beach, dune, Maritime shrubs and forests, salt marsh, man-made impoundments, and grassland habitats. These Refuge habitats support varied and abundant populations of resident and migratory wildlife species including more than 300 species of birds and additional species of mammals, reptiles, amphibians, insects and plants. The Refuge also supports nesting piping plovers, a federally listed threatened species.

Parker River also administers the Thacher Island National Wildlife Refuge, located off the coast of Rockport. Thacher Island historically supported a large tern colony, and has been managed in cooperation with the Town of Rockport and the Thacher Island Association since the late 1990s.

In 2006, we completed a Habitat Management Plan for the two Refuges, which will guide the management of the wildlife and habitats on the Refuges for the next 15 years. The goals, objectives, and strategies from the HMP are incorporated into this Annual Habitat Work Plan and will guide management for 2009.

A. Beach Management for Plovers, Terns and Shorebirds

Habitat Objective

- A. Work cooperatively with State (Sandy Point State Reservation) and local towns (Newburyport and Newbury) to protect from disturbance and degradation nine miles of nesting, staging, and foraging habitat for piping plovers and least terns. Through seasonal closures, predator management and public education, maintain a minimum productivity of 1.5 chicks per pair over a five-year period for piping plovers and a nesting least tern colony of 50-100 pairs.
- B. Annually maintain 182 acres of sandy beach and rocky shore and 540 acres of dune grassland habitat to benefit migrating shorebirds and nesting piping plovers and least tern by regulating and directing public use to less sensitive areas (away from wrack line and nesting areas) and times (after nesting and migration seasons) and away from roost sites in beach ecosystem.

2009 Management Prescription

Starting April 1, the Refuge closed the entire length of the Refuge beach to public access except for the 0.10 mile section north of Lot 1. To further minimize public disturbance, volunteer “plover wardens” are recruited to sit at the north and south end of the beach closure. Plover wardens prevent potential trespassers, educate the public about plovers and the role the Refuge plays in protecting this species, and report any trespass to Refuge staff. Sections of the beach are opened to public use as the chicks fledge. Sections of the beach are opened to public use as the chicks fledge, starting at the south end. The entire beach was re-opened for public use on August 21.

At Sandy Point, the beach area in between the two trails from the lower lot was symbolically fenced on April 1, and the symbolic fence was expanded throughout the summer to

accommodate nesting plovers as the beach built up. No plover activity was observed on the town beaches on the north end of Plum Island and no management activities were initiated.

Monitoring of plover nesting activity began in late March with the arrival of plovers on Plum Island. Starting April 7th, surveys were conducted 2-3 times a week by walking the beach or using an All Terrain Vehicle (ATV). As the plovers establish pair bonds, begin courtship and initiate territory defense, nest searches were conducted daily to locate the nest. Monitoring is conducted 2-3 times a week during incubating period, and 3-4 times a week until the chicks fledge (sustained flight of 100+ feet or 25 days of age). For failed nests, we survey the immediate area intensely to monitor re-nesting attempts and to locate the new nest.

Electric fences were used on the Refuge beach to protect a least tern colony and at Sandy Point to protect nesting plovers and additional nesting terns.

The Refuge contracted with USDA's Wildlife Services for the 3rd year in a row to remove predators that might threaten nesting Piping Plovers. From April 21 through May 14, Wildlife Services conducted 4 nights of trapping and shooting removing 5 red foxes and 1 coyote from Sandy Point State Reservation. On the Refuge, Wildlife Services erected three snow fencing barriers running from mid beach to the top of the dunes at the north end of the beach, and set up shooting blinds at these barriers.

Shorebird Surveys and Shorebird Disturbance Study

We conducted weekly shorebird surveys (April 7th-October 23rd) on the Refuge beach to monitor use during fall migrations. Surveys were conducted at various times during the day and at a range of tides by staff using ATVs.

Shorebird disturbance as a result of human activity was monitored on the refuge beach beginning on August 28. One preliminary survey was also conducted on July 28 prior to the beach opening to pedestrian or vehicle access. Stationary surveys were conducted for one-hour periods to observe shorebird disturbances. At the beginning of each survey period, the total number of birds by species was counted. The total number of human-related stimuli passing by within the survey period was also recorded. These stimuli were separated by the number of individuals and the type of activity (such as walking, running, etc.). All disturbance events were recorded for each survey period. The cause of the disturbance, the number of birds disturbed, the duration of the disturbance, bird response behavior (fly, run, etc.), and bird behavior prior to flushing (foraging, roosting, preening, etc.) were noted.

Dune Protective Fencing

The storms during the summer continued to erode the primary dunes. In August, staff noticed primary dunes sloughing off in many areas, noticeably reduced in height, and beach grass were beginning to recolonize the base of the primary dunes. To protect these dunes from ORV impacts when the beach opened up to ORV use in September, we symbolically fenced off many of these areas from Lot 3 to Seahaven.

Habitat Response

The summer of 2009 was one of the rainiest on record. In May it rained 16 days in Newburyport with a total of 3.99 inches. In June it rained 18 days for a total of 6.35 inches. Rain fell on 17 days in July and 12 days in August, with 8.29 inches of rain and 6.82 inches, respectively. Rainfall averages for Newburyport from 1930-1995 show 3.5 inches of rain in May, 3.4 inches in June, 3.5 inches in July, and 3.2 inches in August. Between June 10 and July 10, it rained 24 days out of 30, resulting in over 9 inches of precipitation. Additionally, a nor'easter storm converged with a 12 foot New moon high tide on June 21 and lingered until June 26, causing storm surges that flooded most of the Refuge beach and Sandy Point Reservation.

Storms in the past few years have removed much of the nesting habitat on the Refuge. During the summer of 2009, several nor'easters brought tides to the base of the primary dune in many areas. Both plovers and terns concentrated their nests in a few stretches of the beach that escaped flooding during these storm surges (mile markers 0.7 to 1.5 and mile markers 2.9 to 3.5). Half of the plovers nested on the first 1.5 miles of beach (Figure 1), and only one of those nests was flooded. There was a second concentration of plover nests between markers 2.5 to 3.5.

At Sandy Point, there is approximately 1.5 miles of available beachfront nesting habitat. All plover and tern nests were located between the two trails from the lower parking lot with the exception of one plover nest. The vegetation between the trails was set back a few years ago by past storms. Sand accumulation in the past few years has built up an extensive bare dune habitat with small hummocks of sparse beach grass, ideal for nesting birds. However, the late June nor'easter flooded the entire area, including the hummocks, resulting in loss of all hatched chicks.

*Response of Resources of Concern*Piping Plovers

In 2009, fifteen pairs of plovers attempted to nest at the Refuge, 12 of which actually laid eggs and fledged 12 chicks. Eight pairs nested at Sandy Point, fledged 2 chicks. No plover activity was observed on the Town beaches. The 23 pairs of piping plovers that nested on Plum Island had a productivity of 0.6 fledglings per pair; down from 0.9 in 2008 and 1.0 in 2007. The five-year average productivity for all of Plum Island fell to 1.0, below the recovery goal of 1.5 fledglings per pair. Although productivity was low, we had the highest breeding pair number since 1995. From 2008 to 2009, the number of breeding pairs increased from 9 to 15 pairs on the Refuge (67%) and 15 to 23 pairs on all of Plum Island (53%).

Flooding was the major cause of nest failure this year (60%). On the Refuge, three nests with eggs were washed out during the June storm, and another nest that was hatching at the time of the storm disappeared. At Sandy Point, two nests were flooded and four families of chicks disappeared during the June storm, presumably due to flooding.

There was a noticeable reduction of nest predation and predator tracks on the beach in April and May. Even though none of the twelve plover nests were exclosed, only one was predated (June 12). Starting in June, predator tracks were seen regularly, and coyote tracks would often cover the entire length of the Refuge beach. Fox tracks were seen less frequently on the Refuge, but were quite common at Sandy Point State Reservation. Dogs were also routinely observed at Sandy Point. Weasel tracks were uncommon, but present.

Interestingly, all the successful plover nests were located in the tern nesting colony. This is probably because those stretches of beach were the best nesting sites. Additionally, the nests located in the tern colony sites were also the first six nests; all but one successfully fledged chicks. The early nesters were successful because they hatched prior to the increased predation pressure in June and a major storm surge that covered the entire beach in late June. It is likely that these first nesters were experienced breeders that successfully defended the best territories and were able to protect their chicks from predation after hatching.

The electric fence at Sandy Point was moderately successful at protecting nesting piping plovers. Although it required a significant amount of maintenance (testing voltage and moving fence to protect new nests), the electric fence did protect five plover nests in May and June. The electric fence was less successful on the Refuge beach where it was used mainly to protect nesting least tern colonies. The colony was very dispersed this year and nested within flooding zones. We attempted to protect some of the nests using electric fence, but subsequent high tides washed out both nests and fencing.

For a detailed report on the plover and tern management program, see the 2009 Annual Plover and Tern Report.

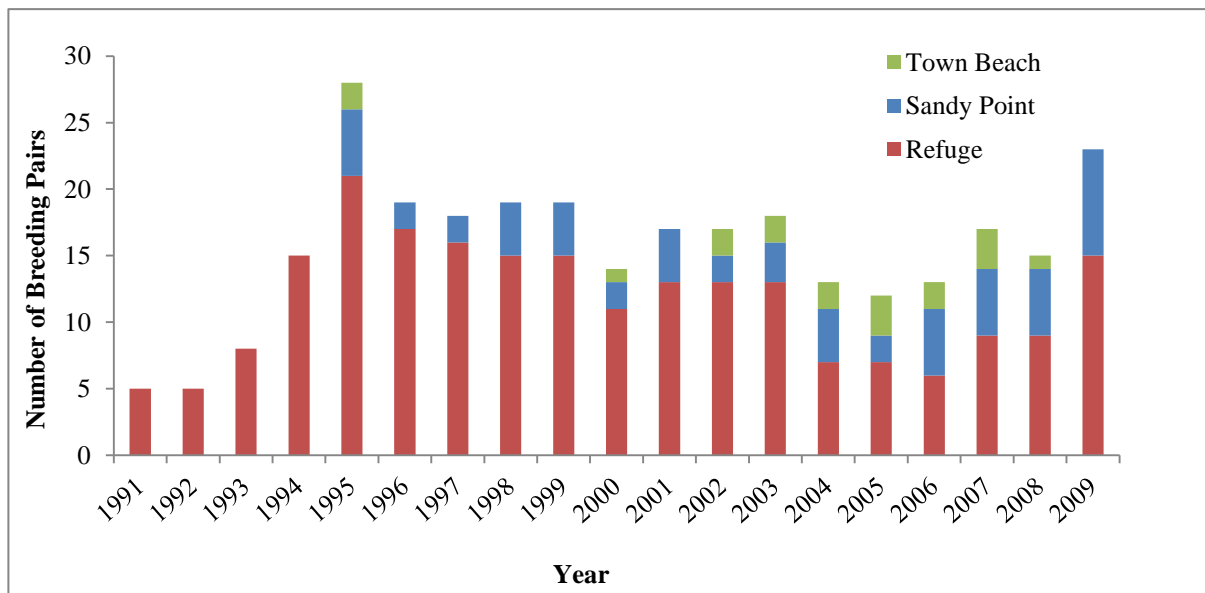


Figure 1. Breeding pairs of piping plovers from 1991 to 2009 on Plum Island, Newbury, MA. The Refuge started monitoring plovers at Sandy Point and Town Beaches in 1995. 2009 had the highest breeding pairs since 1995.

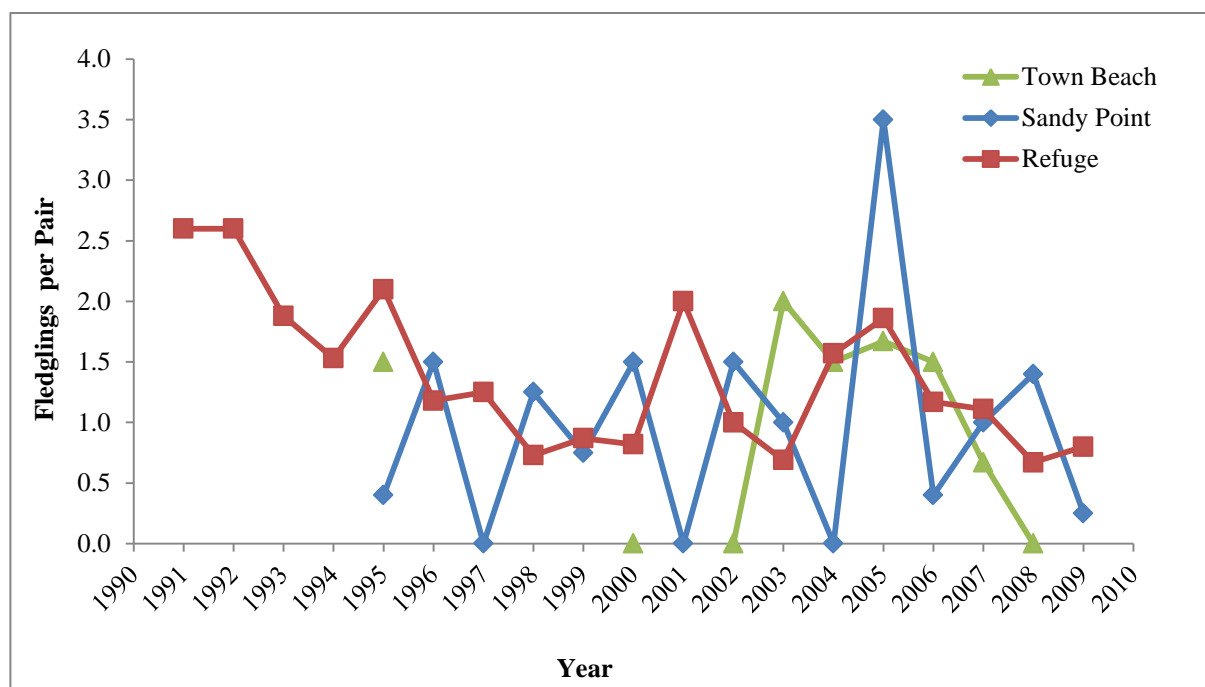


Figure 2. Productivity for the three managed beaches on Plum Island. The average productivity is 1.3 for the Refuge beach, 0.8 for Sandy Point, and 1.1 for the Town beach.

Least Terns

There were a total of three tern colonies on the beach, located at mile markers 0.8, 1.05, and 3.1. Fifty pairs of terns were estimated for all colonies on the Refuge beach on June 9, with another estimate of 48 pairs on July 9. Most of the nests on the Refuge beach were washed out by high tides and/or extreme weather events. A few chicks were observed in August, but it was difficult to determine the fate of the chicks. We estimated, at most, three tern chicks were fledged from all colonies on the beach. Some terns (9 to 30 individuals observed) attempted to nest at Sandy Point, but the colony dispersed by late June when we removed the electric fence after the flooding tides.

Shorebirds

Fall shorebird migration began in late July on the Refuge beach and continued through mid-October. The peak of migration (2,325 birds) was observed on August 11th (Figure 3). The most abundant species on the Refuge beach throughout the survey period of May to October were semipalmated sandpipers, semipalmated plovers, and sanderlings. Concentrations of shorebirds were found along the Refuge beach, with roosting sites located near mile markers 0.5, 4.0, and 5.0.

2010: Management Strategy Prescriptions

- Continue to implement management actions to maximize productivity of piping plovers and least terns on Refuge, town, and State beaches on Plum Island.
 - Close the Refuge beach beginning April 1, including beach access lots 2, 3, 6, and 7. Parking lots will remain closed while those sections of the beach still support nesting activity for plovers and terns.
 - Working with DCR, Federal and State Endangered Species Programs, and towns of Newbury and Newburyport, further minimize disturbance of plovers nesting on town and State beaches by increasing signage and enforcement.
 - Continue to contract with USDA to reduce predation pressures at the north end of the Refuge and at Sandy Point at the start of the plover nesting season. Concentrate predator control efforts in March and April, and closely monitor predation on plovers and terns and target problem animals during the nesting season.
 - Continue to use electric fence around tern nesting colonies on the Refuge beach and plover and tern nests at Sandy Point.
 - Closely monitor nesting plover pairs, and adjust management (e.g. installing symbolic fencing, predator exclosures) as needed.
 - On a case by case basis, evaluate the pros and cons of nest exclosures and install circular exclosures if risk of adult predation is low.
 - Install surveillance cameras on selected nests to monitor nesting behavior and predation pressure.
 - Educate the public on piping plovers by providing live video of nesting plovers at the Visitor Contact Station and Visitor Center and staffing display tables at Lot 1.
 - Improve nesting pair and productivity estimated for nesting least terns by doing nesting pair counts 2x a week and conducting double-observer nest counts (with beach debris nest markers) when terns are actively incubating. Pilot using time-series photography for 24-hour period to obtain nesting pair count.

- Continue to monitor shorebird use on the beach, use of roosting areas, and potential human disturbance impacts on shorebird use.

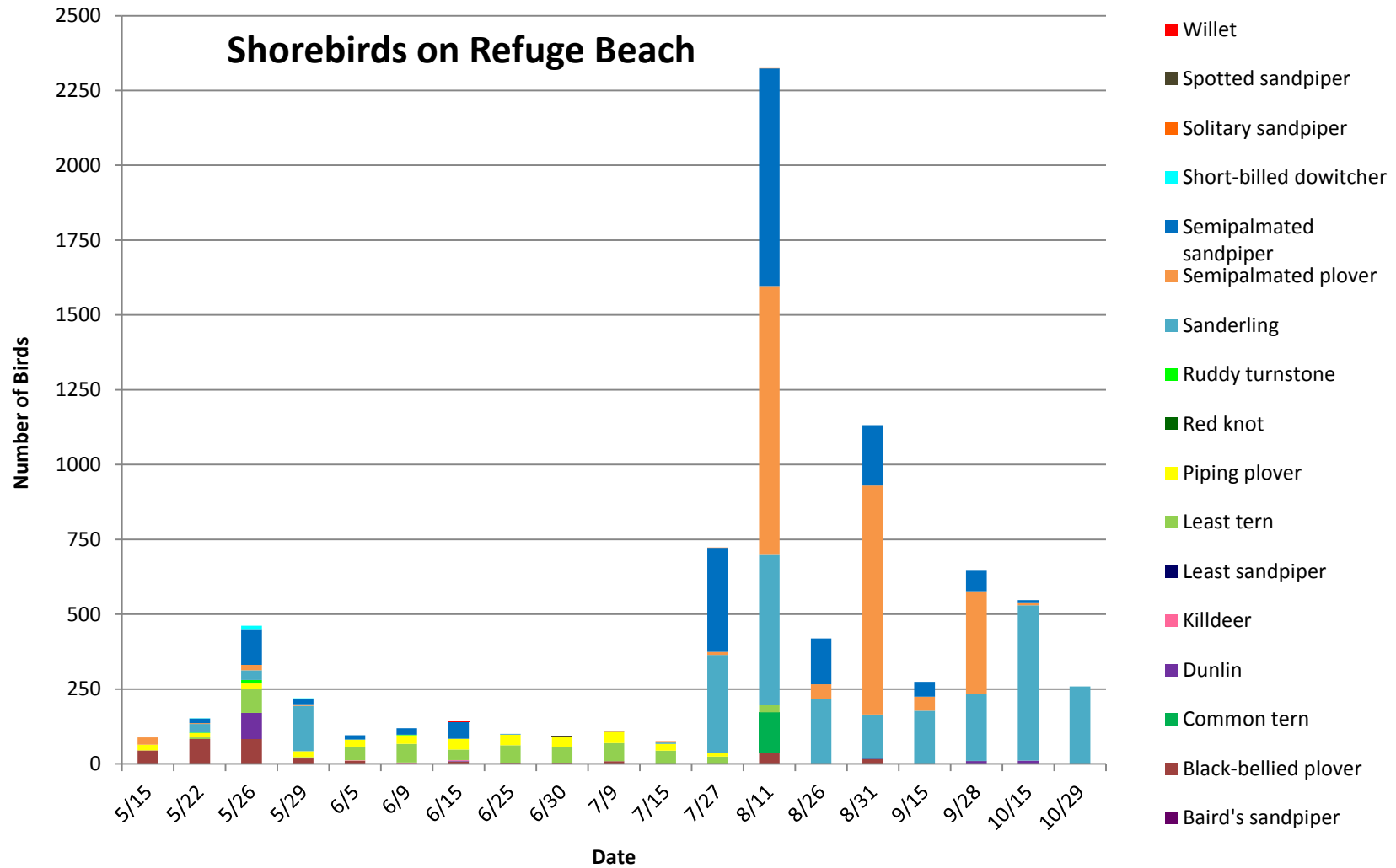


Figure 3. Summary of weekly shorebird surveys conducted on Refuge beach from May to October, 2009.

B. Maritime Shrubland and Forests

Habitat Objective

Manage 333 acres of maritime shrubland and forest to provide nesting and migratory stopover habitat for landbirds of conservation concern including eastern towhee, brown thrasher, prairie warbler, and to benefit the New England cottontail. Specific management objectives are:

1. Annually, maintain a minimum of 100 acres of maritime shrub and forest habitat with medium to high stem density (>10,000 stems/ha) to provide nesting and feeding habitat for eastern towhee, brown thrasher, and prairie warbler.
1. By 2021, increase native maritime shrub and forest communities (dominated by native fruit-bearing shrubs and trees, including shadbush, black cherry, arrowwood, beach plum, bayberry, and elderberry and comprising less than 5% invasive plants) to 50-100 acres to benefit fruit-eating migratory landbirds.

2009 Management Prescription

Monitoring and Surveys

Massachusetts Audubon has been running a spring and fall migratory banding station in the shrub habitat on the Refuge since 1998. The spring banding season began on April 1st and closed on June 1nd, with a total of 52 birding days. The fall banding season began on August 28th and closed October 31st, with a total of 53 banding days.

Shrub Adaptive Management Project

We initiated an Adaptive Management Project in 2008 along with Rachel Carson, Great Meadows and Rhode Island National Wildlife Refuges to restore shrub habitat at the four refuges. We chose two objectives (restoring fields to native shrubs and restoring exotic to native shrubs) and two treatment intensities (low and medium). Each Refuge selected treatments that would best restore habitat to their target conditions, and where possible, we paired similar treatments and treatment units (see Table 1). The focus of Parker River's restoration is to improve native species diversity in the maritime shrublands and to provide optimal habitat for migrating songbirds. We chose to restore an 8-acre old field (south end of North Pool field), and a 16- acre maritime shrub unit.

Table 1. Restoration objectives and treatment regime for shrub restoration at four Refuges in New England.

CONVERTING EXISTING GRASSLAND TO SHRUB DOMINATED HABITAT				
Treatment	RHC	PKR	GRM	RI
Low intensity: Yr 1: Let go to shrub, foliar application during growing season and/or targeted mowing Yr 2—Yr x: Targeted invasive treatments—spot treatments with Garlon for invasive shrubs only.		X	x	
Medium Intensity: Yr 1: Let go to shrub, foliar application during growing season and/or	x		x	

targeted mow or hand pulling (plant natives at RHC) Yr 2-Yr x: Targeted invasive treatments with herbicides or hand-pulling (RHC); plant natives (broadcast seed, propagate) if necessary.				
MAINTAINING / ENHANCING EXISTING SHRUB DOMINATED HABITAT				
Low Intensity: Yr 1: Spot treat (invasive only) with combination of mechanical and chemical Yr 2: monitor for reprints, and retreat as needed. Repeat as necessary.		X		x
Medium Intensity: Yr 1: Selectively treat (invasive / tree / 'over mature') using mechanical (and /or chemical) means. Optional: Dormant season burn to increase stem density. Optional: Transplant shrubs to increase diversity (structural & compositional)	x			x
Control: No management; monitor only	x			x

Each Refuge monitored up to 7 matrices that feeds into a model that will helps us learn the best methods for restoring shrublands on each Refuge and regionally. The 7 matrices include: species composition, density (cover boards and stem counts), ecological integrity, berry production, use by New England Cottontail and use by migratory birds. All Refuges collected pre-treatment data, and all matrices would be monitored every 2 years to update the model. Selected matrices would be monitored in interim years as needed.

In 2008, we contracted with Vegetation Control Services to treat invasive shrubs in the shrub unit. Treatment was conducted with triclopyr on September xx. In 2009, VCS returned on October 15th to treat invasive shrubs, mostly glossy buckthorn, in the field unit using pack back sprayers and triclopyr.

In 2008, Parker River monitored all matrices except stem counts and NEC use. In 2009, we monitored bird use and berry production. We will re-measure all matrices in 2010 and update the model to assess change in habitat and bird use.

Herbivore Management

The annual deer hunt was held on December 9th. Thirty hunters participated in the hunt and harvested no deer. No deer was harvested.

Habitat Response

Invasive Plant Management

In 2009, 23 stands of muliflora and rugosa rose along the roadside and boardwalks were treated with 15 gallons of herbicide. These points will be monitored in 2010 and any additional stands mapped and treated as necessary.

Shrub Adaptive Management Project

The most abundant plant species found in the shrub unit is Morrow's honeysuckle, bayberry, and black cherry. Invasive plants (mainly Morrow's honeysuckle and buckthorn) were found in 30% of the points sampled, however it only comprised 16% of the total biomass. The most abundant plant species in the field unit were bayberry, buckthorn, Virginia rose, black cherry and poison ivy. Invasive plants, mainly glossy buckthorn was found in 8% of the points, whereas it makes up 13% of the total biomass.

Shrub habitat prior to treatment (2008) had a high density cover (38% cover over 1 meter, and 15% under 1 meter). Field habitat had 15% cover over 1 meter, and 2% cover under 1 meter.

Table 2. Percent cover of plants species and invasive plants found in Shrub treatment unit.

Shrub Unit		Field Unit	
Species	Total	Species	# Hits
Amelanchier ssp.	20	Acer rubra	1
Betula populifolia	8	Betula papyrifera	1
Frangula alnus	15	Frangula alnus	10
Hudsonia tomentosa	14	Hudsonia tomentosa	2
Ilex verticillata	17	Ilex verticillata	1
Lonicera spp.	43	Lonicera spp.	3
Myrica pensylvanica	39	Myrica pensylvanica	12
Parthenocissus quinquefolia	15	Prunus virginiana	7
Pinus rigida	14		
Populus tremuloides	11		
Prunus maritima	1		
Prunus serotina	42		
Quercus rubra	3		
Rosa virginiana	2	Rosa virginiana	9
Rubus flagellaris	1	Rubus flagellaris	20*
		Rubus hispidus	1
Smilax rotundifolia	6	Spirea alba	5
Toxicodendron radicans	5	Toxicodendron radicans	7
Vaccinium macrocarpon	95*	Vaccinium macrocarpon	4
Viburnum dentatum	3	Viburnum dentatum	1
Grand Total	354		84
% invasives	30	% invasives	15
Native Biomass	302	Native Biomass	70
Total Biomass	361	Total Biomass	82

*Certain species, such as cranberry and dewberry had numerous arching canes that touch the point intercept bayonet, thus confounding the biomass measurements. For biomass calculations, these species were not included.

Response of Resources of Concern

Shrub Adaptive Management Project

Bird use was monitored using 20 minute area searches, each area roughly totaling 1 hectare. The Shrub unit was monitored in three 20-minute plots while the Field unit was monitored in two 20-minute plots. Bird abundance and bird use data will be analyzed by Klamath Bird Observatory. Below is a summary of preliminary data.

In the shrub unit, pre-treatment (2008), we observed 34 species in 407 minutes of searching. Capture per effort was 19 birds per 20 minute search, dominated by myrtle warbler, song sparrow, gray catbird, American robin, blue jay, and black-capped chickadee. In 2009 (post treatment), we observed 19 species in 345 minutes. Capture per effort was 9 birds per 20 minutes, dominated by Myrtle warbler, American robin, blacked capped chickadee, eastern towhee, blue jay, and gray catbird.

In the field unit (pre-treatment, 2008), we observed 21 species in 164 minutes of searching. Capture per effort was 12 birds per 20 minute search, dominated by song sparrow, eastern phoebe, myrtle warbler, white-throated sparrow and gray catbird. In 2009 (post treatment), we observed 11 species in 147 minutes. Capture per effort was 2 birds per 20 minute search, dominated by eastern Phoebe, gray catbird, and Myrtle warbler.

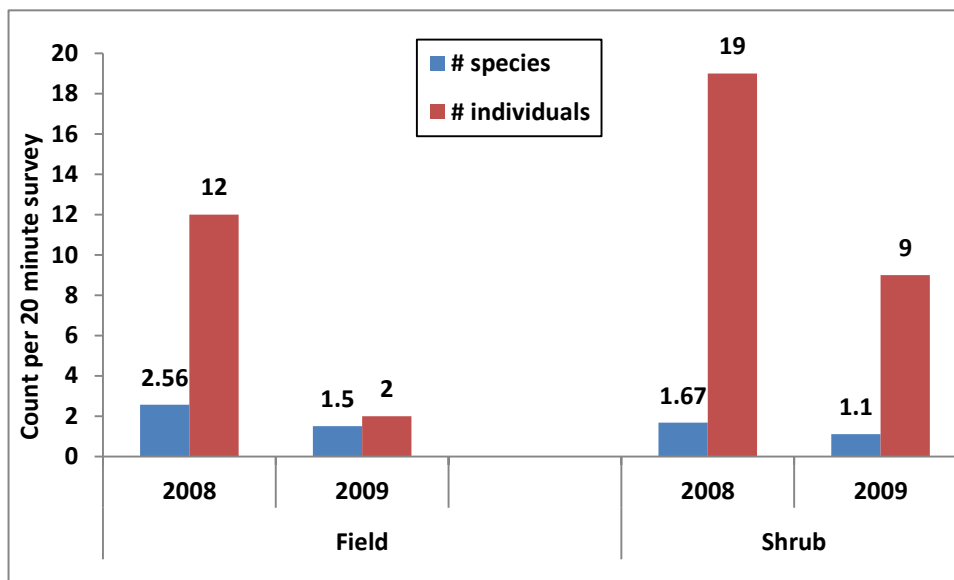


Figure 3. Number of species and number of individual birds observed during 20 minute area searches in Shrub and Field units pre and post treatment.

It is unclear if the decrease in bird use from 2008 to 2009 was due to treatment effects, or to other variables, such as observer effect, timing of bird surveys, and annual and daily variation in bird use. Next year, we plan to add a control unit to the bird surveys (area search and activity budget) to tease out some of these differences. Further power analysis by may also determine if the difference among years is due to treatment effects.

In 2009, we also monitored bird activity in the shrub area. We observed Myrtle warblers, black capped chickadee, American robins, brown creepers, and white-throated sparrow. Surprisingly, the birds spent a disproportionate amount of time in pitch pine. While pitch

pinus make up only 15% of the biomass, birds spend roughly 40% of time in pitch pines. On the other hand, the fact that most shrubs were dead may explain why the survey observed birds using taller trees or vines.

Table 3. Percentage of bird use in host plants during activity budget surveys.

Host plant species	% time
Pitch pine	39
Black cherry	30
Cultivated apple	12
Virginia creeper	10
Quaking aspen	7
Glossy buckthorn	1

Audubon Banding Station

In 2009, the Massachusetts Audubon banding station banded 87 species totaling 3,372 birds with a banding effort of 9,164 net hours. The most common species captured during spring were common yellowthroat, magnolia warbler, gray catbird, and American redstart. The most common species captured during the fall migration were Yellow-rumped warbler, gray catbird, white-throated sparrow and ruby crowned and golden crowned kinglet. Recapture data indicate that Parker River NWR is an important stopover area for migrating song birds, particularly during the fall migration. This is especially true for young birds (hatched the same year), as they make up 81 to 94 percent of all birds captured during the fall migration. Recapture data also demonstrate that birds exhibit significant weight gain during their stay, indicating that the Refuge is providing good stopover habitat.

Table 4. Number and species of birds banded at the Massachusetts Audubon banding station at Parker River Refuge from 2001 to 2008.

Year	Spring			Fall			Total	
	# sp	# bird	catch per effort	#sp	# bird	catch per effort ¹	# sp	# bird
2009	75	2136	49.3	65	1687	34.92	87	3372
2008	69	1670	35.55	64	1464	37.74	80	3134
2007	62	1832	56.32	70	1486	27.90	81	3309
2006	45	452	20.62	62	1396	33.63	70	1848
2005	48	930	42.31	66	1758	58.1	72	2359
2004	69	1361	51.00	66	2092	38.88	87	3453
2003	62	698	36 days*	45	881	39 days*	76	1579
2002	69	1473	63.8	57	1176	41.5	82	2649
2001	62	893	44.25	62	1484	59.67	76	2377

*net hours were not available in 2003 to calculate catch per effort

2010 Management Strategy Prescription

- Continue to partner with Massachusetts Audubon Society to monitor landbird use of maritime shrub and forest habitat during spring and fall migration through the

¹ Catch per effort is calculated as the total number of birds caught per 100 net hours. For 2003, catch per effort was not calculated as survey effort was recorded in days instead of net hours

banding program. Expand banding effort to August to capture post-fledgling individuals and assess health of surrounding landscape.

- Continue the annual one-day deer hunt program to maintain a sustainable deer population.
- Conduct point-intercept, line intercept, robel pole, berry production, and birds surveys in the Shrub restoration units. Add control unit to bird monitoring to account for annual variations in bird use. Monitor for plant regrowth and follow-up on post-treatment invasives. Test elev  survey method and compare to point and line intercept method.
- Control invasive plants through cutting, girdling, pulling, herbicide application targeting at eradication of certain early detection species (e.g. black locust, rusty willow, autumn olive, multiflora rose), and restoring areas of low invasion.
- Initiate a volunteer-based phenology monitoring of representative shrubs and trees to monitor habitat and plant response to climate change.

C. Exemplary Plant Communities

Habitat Objective

Maintain the native plant diversity, physiographic characteristics, and natural functions of the refuge's exemplary plant communities -- interdunal swale, sandplain grassland, and pitch pine dune woodland.

2009 Management Prescription

In 2008, we contracted with Vegetation Control Services to remove x acres of black pines. On April 18 and 22, we held public pitch pine planting events to plant 30 4' pines in a 0.7-acre area cleared the previous year. About 30 volunteers ranging to ages 4 to 87 assisted in the plantings.

Habitat Response

Invasive Plant Managemnet: The Japanese knotweed stands at Sandy Point were treated in late September 2009 with 5% glyphosate solution applied with a spray bottle. This small scale approach was appropriate as only a few, small stems remain. Monitoring and follow-up treatment, if necessary, will occur in fall 2010.

Response of the Resources of Concern

N/A

2010: Management Strategy Prescription

- Monitor pitch pine restoration sites for invasive plants and treat with backpack sprayer as needed.

- Conduct surveys for *Aristida tuberculosa* in sandplain grassland. Relocate historic populations at sub-HQ and mowed fields, and adjust mowing as needed.
- Initiate a vernal pool inventory and assessment project to determine which interdunal swale serve as vernal pools. For this pools, assess
 - Presence of breeding anuran species
 - Extent and hydroperiod of vernal pool habitat
 - Plant community within and surrounding vernal pools
 - Presence of *Arethusa bulbosa* (Dragon's mouth) last sighted in 1971
 - Presence of invasive plants (Phragmites, purple loosestrife, rusty willow)
- Install cover-boards in dunes and shrubs to inventory snake and salamander densities and species composition
- Conduct spring frog-call survey to monitor spadefoot toad population index
- Work with YCC to remove invasive understory in Lot 5 Pitch Pine community and remove black pine seedling in dune areas and Bill Forward Shrub area.

D. Salt Marsh

Habitat Objective

Annually, manage 2,660 acres of salt marsh, including a mix of high and low salt marsh vegetation comprised of less than 5% overall cover of invasive plants, and pool and panne habitat consistent with local reference sites, to ensure that the quality and natural function of the marsh are sustained and provide breeding habitat for Nelson's and saltmarsh sharp-tailed sparrows, and seaside sparrow, wintering areas for American black duck, and foraging areas for marsh and wading birds and migrating shorebirds.

2009 Management Prescription

Salt Marsh Integrity Index

Parker River conducted a second year of monitoring to test rapid assessment monitoring protocols to assess the ecological health of salt marshes throughout the US. We monitored bird, nekton, and vegetative community data at three study plots: Grape Island, Nelson's Island and an the Salt Pannes area that had been previously OMWM'ed.

Mercury Bioaccumulation Study

In 2004, a multi-refuge contaminants investigation found Parker River Refuge to have the highest blood mercury among all salt marsh sharp-tailed sparrows sampled in New England. Since 2006, we have been investigating potential impacts to reproductive success and potential point sources of mercury in the Plum Island Sound watershed, working in partnership with Rachel Carson Refuge, which acts as the control in the study. In 2009, we:

1. Continued to study mercury level in birds and potential impacts to reproductive success
2. Sampled sediment cores for historic and current sources of Hg along several drainages

3. Sampled methyl and total mercury and isotope signatures at various levels within the food chain (sediment, plant, invertebrates, sparrows) to identify trophic pathway through which sparrows are bioaccumulating mercury.
4. Used i-buttons and field observations to study nesting and foraging behavior.

Monitoring and Surveys

Surveys conducted in the salt marsh include the salt marsh sparrow survey and the colonial nesting bird survey (coordinated by the State). The salt marsh sparrow survey was conducted three times during 2009: June 13, July 19 and August 14. The colonial nesting bird survey was conducted on June 11th.

Invasive Plant Control

The Refuge has been coordinating several community-based invasive plant control programs in an effort to eradicate these species from the Refuge and surrounding areas. In 2009, we:

- Continued the community perennial pepperweed control project on the refuge and in the towns of Salisbury, Newburyport, Newbury, Rowley, Ipswich, Essex and Gloucester.
- Continued the partnership with Eight Towns and the Bay and Ducks Unlimited to control and study *Phragmites* in the Great Marsh.

Habitat Response

Invasive Plant Control

Perennial pepperweed: 223 volunteers contributed 520 hours between May and August to control pepperweed both on refuge lands and in the Great Marsh region. Volunteers participated both in extensive mapping and mechanical pepperweed control. 35 sites were pulled with volunteer help. Staff also applied 0.05% Escort solution with backpack sprayers to 95 stands. All pepperweed stands on the Refuge were treated with herbicide in 2009.

Phragmites: From September 21-24, a contractor treated *Phragmites* stands in the “Upper Great Marsh” continuing emergent *Phragmites* stand control. A mixture of imazapyr and glyphosate was used to kill the *Phragmites*. All visible *Phragmites* was targeted between the Plum Island Turnpike, Plum Island River, Little Pine Island Road and the western upland edge. *Phragmites* on Woodbridge Island was also treated.

Response of Resources of Concern

Mercury Bioaccumulation Study

In 2009, 46 saltmarsh sparrow nests were found; 19 nests were found during the first cycle (June) and 27 during the second (July). As tidal cycles greatly affect nesting

success, we divided the nests into cohort groups (nests that initiated incubation at roughly the same time) for the purpose of calculating reproductive success (see Table x).

Table 5. Saltmarsh sparrow productivity during 2008 and 2009 nesting season at Parker River NWR.

	Cycle 1 2009	Cycle 1 2008	Cycle 2 2009	Cycle 2 2008
Nests Found	19	33	27	22
Nests with Eggs	17 (90%)	25 (76%)	26 (96%)	18 (82%)
Nests hatched	8 (42%)	9 (27%)	14 (52%)	13 (59%)
Nests Fledged	0 (0%)	7 (21%)	10 (37%)	8 (36%)
Fledglings	0	16	30	25
Nests Predated	6 (31%)	14 (42%)	6 (22%)	9 (41%)
Percent of Nests Flooded	11 (58%)	1 (3%)	9 (33%)	0 (0%)
Percent of Nests Abandoned	2 (11%)	11 (33%)	1 (4%)	5 (23%)
Mean Nest Height (cm)	11.0	8.4	12.7	9.41

Heavy rain and surging storm tides caused extensive flooding of the salt marsh in 2009. As expected the majority of nest failure was due to flooding. During the first cycle 58% of the 19 nests failed due to flooding, and the rest failed due to predation. During the second period 33% of the 27 nests failed due to flooding while 37% (n=10) produced fledglings.

Table 6. Mayfield probability of reproductive success for Saltmarsh sharp-tailed sparrows at Parker River 2006 – 2009, and Rachel Carson NWR 2006. Flooding in 2009 dramatically reduced nesting success. The hatching rate was similar to last year and significantly higher than 2007 and 2006.

	Probability of Egg Surviving Incubation	Probability of Nestling Fledging	Hatching Rate	Probability of Nesting Success
Parker River 2006	0.4164 - 0.4941	0.7486 - 0.8107	0.5322	0.1659 - 0.2132
Parker River 2007	0.3910 - 0.4735	0.8995 - 0.9370	0.7592	0.2670 - 0.3368
Parker River 2008	0.4315 - 0.4924	0.6710 - 0.7286	0.9189	0.2660 - 0.3297
Parker River 2009	0.3178 - 0.3970	0.4461 - 0.5381	0.9091	0.1289 - 0.1942
Rachel Carson 2006	0.7134 - 0.7791	0.4619 - 0.5730	0.8478	0.28 - 0.38

We deployed small electronic temperature dataloggers (Thermochron iButtons) in 15 nests during the 2nd cycle to collect additional information about nest attentiveness and capture flooding events. The temperature logs were very useful in determining nest fate and major events at the nests, such as flooding, predation, and abandonment. We were

able to observe frequency and duration of foraging bouts, whether nests had eggs or chicks (estimate hatching time), and day vs. night incubation.

iButton data showed that nest fate determination based on field observations were often not accurate. We monitored 10 nests during the incubating period. Three nests that we recorded as flooded were actually not active, and one nest that we coded as predated (eggs gone from nest) was actually abandoned the morning after it was flooded for 4 hours (the eggs could have been predated at a later time). We monitored 8 nests during nestling period, 7 of which were thought to have fledged. iButton data showed that only 1 of these successfully fledged, while 5 were flooded and 1 was predated.

It is often difficult to balance disturbance (and potential harm) to wildlife and the need to collect accurate data. We have been monitoring the nest every 2-3 days to minimize disturbance to the birds and prevent adult abandonment. Because the sparrow's reproductive cycle is so shortened (10 days incubation, 8 days to fledge), that means we're extrapolating nest fate based on 2 to 3 visits. In 2009, most nests were checked when the chicks were 4-5 days old, then again at 9-10 days. If the chicks were missing and there were no signs of predation, the chicks were assumed to have fledged. iButton data showed that most of the nests flooded at day 6, resulting in failure. The high flooding tide also occurred on a weekend, when staff was not scheduled to work. In future monitoring, we will have to schedule monitoring carefully to make sure that we monitor right before a flood tide and before the chicks are able to leave the nest, e.g. chicks 6-8 days old. We will also continue to use iButtons to correlate with field observations.

Trophic pathway mercury investigations

In July, we collected samples from all trophic levels to test for methyl and total mercury and stable isotope analysis. The various taxa samples we collected is listed in Table 7 below, along with the analysis that will be run on each sample. The results of these samples will be available in April 2010 and will determine our research direction in 2010.

Table 7. Samples collected from Parker River and Rachel Carson Refuge for mercury and isotope analysis.

	Parker River			Rachel Carson		
	THg; MeHg	THg	Isotope	THg; MeHg	THg	Isotope
Sediment Core	15	0	15	15	0	15
EPA Sediment	11	0	0	0	0	0
Veg	0	12	12	0	13	13
Dip Larv	15	0	8	14	0	12
spiders	15	0	13	15	0	15
Amphs	15	0	13	15	0	15
Dip Adults	15	0	12	15	0	15
Orthoptera	15	0	15	15	0	15
Sparrows		10		0	17	0
Totals	101	22	88	89	30	100

To investigate the source of mercury, EPA took nine shallow and deep sediment cores across the various rivers that feed Plum Island Sound using a Russian borer. The cores will be sectioned and tested for total mercury to determine which rivers may be contributing mercury to the system. Testing multiple core depths will tell us whether the source is current or historic. Further core sampling in coming years is expected to follow any positive results to its source.

Monitoring and Surveys

The breeding tern population in the Plum Island Sound increased compared to recent years, particularly along the Plum Island River. Substantial colonies appear to be establishing on Pork Island and just south of Plum Island Turnpike.

Table 4. Common tern breeding pairs observed nesting in Plum Island salt marshes during the State count window (mid June) from 2002 to 2007.

Year	Woodbridge	Plum Island Sound Marshes	Total
2007	58	104	162
2006	67	50	117
2005	80	21	101
2004	96	26	122
2003	75	24	99
2002	80	24	104

For a fifth year in a row, the number of sharp-tailed saltmarsh sparrows detected during the annual breeding surveys continues to be high (Figure 4).

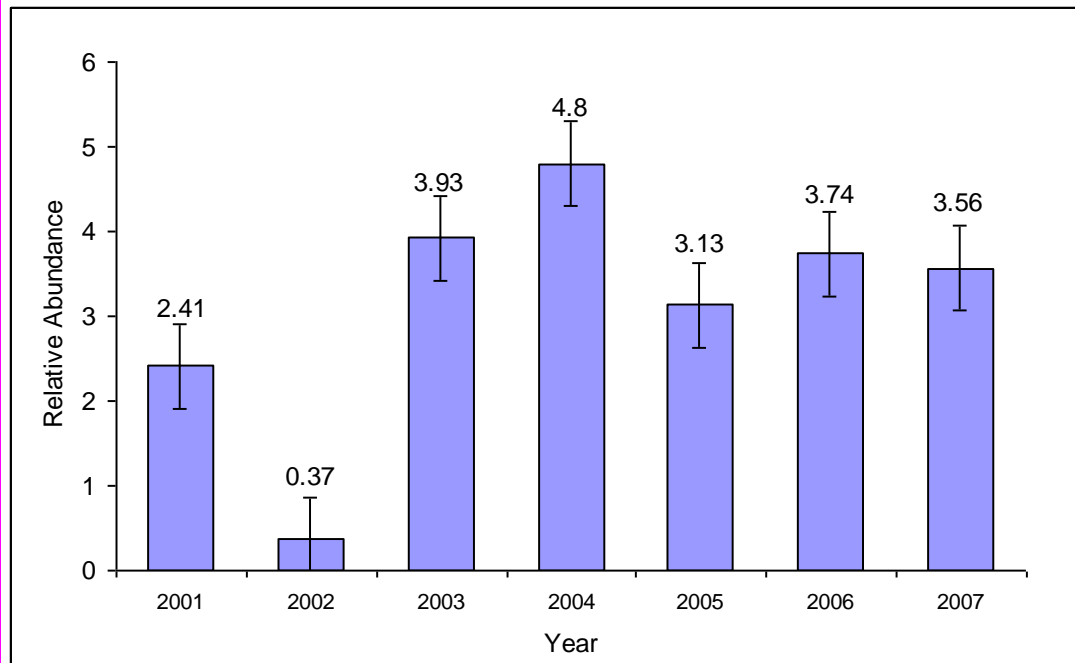


Figure 4. Relative abundance of sharp-tailed saltmarsh sparrow in call-back surveys, calculated as total number of individuals divided by total survey points. Three surveys were conducted for 2001, 2002, and 2007 breeding season. From 2003 to 2006, only one survey was conducted per year.

2010: Management Strategy Prescriptions

- Conduct three saltmarsh sharp-tailed sparrow surveys, corresponding to the start of each breeding cycle. Conduct annual common tern surveys within the State census window. Do follow up survey at Woodbridge Island to estimate productivity for the colony.
- Continue to participate in the ongoing mercury bio-accumulation study in saltmarsh sparrows, and seek additional funding to expand research to investigate the geographic and biological (species) scope of mercury and other contaminants (e.g. PCBs, organophosphates).
 - Continue to monitor the reproductive success of saltmarsh sparrows and potential impacts from Hg.
 - Use iButtons and remote cameras to monitor nesting success and bird behavior.
 - Further investigate trophic pathway bioaccumulation of mercury in sparrows.
 - Conduct systematic study to determine nesting and foraging habitat preferences and nest fate.
 - Continue to work with EPA to investigate point sources for Hg in the watershed.

- Color band all captured adults and additional fledglings to investigate wintering range, winter survival, and fidelity of fledglings. Work with VA Field Office to investigate wintering ground of Parker River birds using stable isotope analysis.
- Pilot passive RFID tags to monitor sparrow movement.
- Conduct follow-up monitoring for the OMWM study as per regional protocols.
- Continue to control invasive plant species (*Phragmites*, perennial pepperweed, Japanese knotweed) in the salt marsh through cutting, hand pulling, stem injection, and herbicide application (cut and drop or spot treatment).
 - Continue off-Refuge Japanese knotweed control and treat all stands on Plum Island and along the turnpike.
 - Continue to control perennial pepperweed through the Great Marsh. Work with partners to the North and South to coordinate regional efforts.
 - Continue to treat emergent *Phragmites* in the salt marsh, and experiment with various treatment techniques.

E Grassland and Early Successional Habitats

Habitat Objective

Manage 80 to 130 acres of grassland habitat with minimum size of 20 acres at a height of 8 to 12 inches during the summer to provide nesting habitat for grassland nesting birds, such as bobolink and northern harrier, and migration habitat for Lepidoptera, whimbrels, and other species.

2008 Management Prescription

Grassland and Early Successional Habitat Management

The Refuge maintains 120 acres of grasslands through annual mowing to provide breeding and migratory habitat for grassland dependent species such as the Northern Bobolink, Savannah Sparrow, Meadowlarks and several species of raptors including Short-eared owls and Northern Harriers. The open field habitat include: the North Pool Field, south portion of the Bill Forward Field, Cross-Farm Hill, Stage Island Field, and Nelson's Island. The southern half of the North Pool field (10 acres) is being restored to maritime shrubs as part of the Shrub Restoration Adaptive Management Project (see Maritime Shrub section).

In 2009, the maintenance staff spent 138 hours mowing the open fields from July 31 to September 10th. Stands of goldenrod, milkweed, and asters are left for nectar and migrating host plants for butterflies and moths at Nelson's Island and Cross Farm. We also mowed the shrub mosaic between the Parking Lot 4 and the Bill Forward Field this year to maintain the early successional habitat.

Invasive Plant Management

In mid-August, we spot treated small stands of spotted knapweed totaling less than an acre in grassland habitats throughout the Refuge with 1.5% Garlon (tryclopyr).

Habitat Response

Invasive Plant Control

Control of spotted knapweed and multiflora rose has been found to be over 90% effective in past year, and is assessed visually.

2010: Management Strategy Prescriptions

- Mow grassland units after bird breeding season (July 31). Follow up with spot treatment of invasive shrubs in the Bill Forward shrub area.
- Map and treat black swallowwort at Cross Farm; and continue spotted knapweed and leafy spurge control
- Conduct survey for *Aristida tuberculosa* (State-rare plant) and adjust mowing regime as needed.
- Conduct grassland breeding bird survey at Cross-Farm, Stage Island, Nelson's, and North Pool field and Bill Forward field to assess nesting species and densities.

F. Impoundment Management

Habitat Objective

Annually manage the three brackish impoundments (totaling 262 acres) to support spring and fall migrating shorebirds, spring and fall migrating waterfowl (American black duck), and breeding marsh and wading birds. Management prescription will change from year to year, dependent on wetland dynamics and vegetative composition, but will be directed to provide the following each year:

1. Migrating shorebirds: shallow (<10 inches water depth) to mudflat habitat with sparse (<15% cover) to no vegetation, at time of peak migration (late May and early August)/
2. Fall migrating waterfowl: shallow flooded (<12 inches) annual vegetation composed primarily of *Cyperus*, *Echinochloa*, *Polygonum*, *Bidens* and other seed producing moist soil vegetation at time of peak migration (late October to early November)
3. Manage for breeding wading birds (e.g. clapper rail, American bittern, king rail, least bitter, marsh wren, sora) and waterfowl (e.g. black duck, green-winged teal, gadwall) by maintaining water levels and controlling invasive plants.

2008 and 2009 Management Prescriptions

North Pool

In September of 2008, the Phragmites in the North Pool was aerially sprayed. In October 2009, we drew down the water level in North Pool to mow the vegetation. Northeast Mosquito Control spent xx hours to mow the Phragmites in the North Pool using a xxx. Water levels filled naturally following the mowing.

Bill Forward and Stage Island

Both Bill Forward and Stage Island pools were aerially sprayed in September of 2008. The Phragmites in Stage Island and Bill Forward Pools were then mowed in October and November of 2008 and the water level in the pools raised.

In 2009, water was held in Stage Island Pool until early August to stymie the growth of Phragmites. We started drawing the water down in August for the fall waterfowl migration.

In the Bill Forward Pool, we started drawing down water in mid April for spring shorebird migration (2.3-2.5 ft). Water was drawn further down in July for the fall shorebird migration (0.8-1.3 ft), and raised slightly starting mid-August (1.5-2.0 feet) for the waterfowl migration. Water level dropped in November due to technical difficulties with the planks, and was flooded in early December.

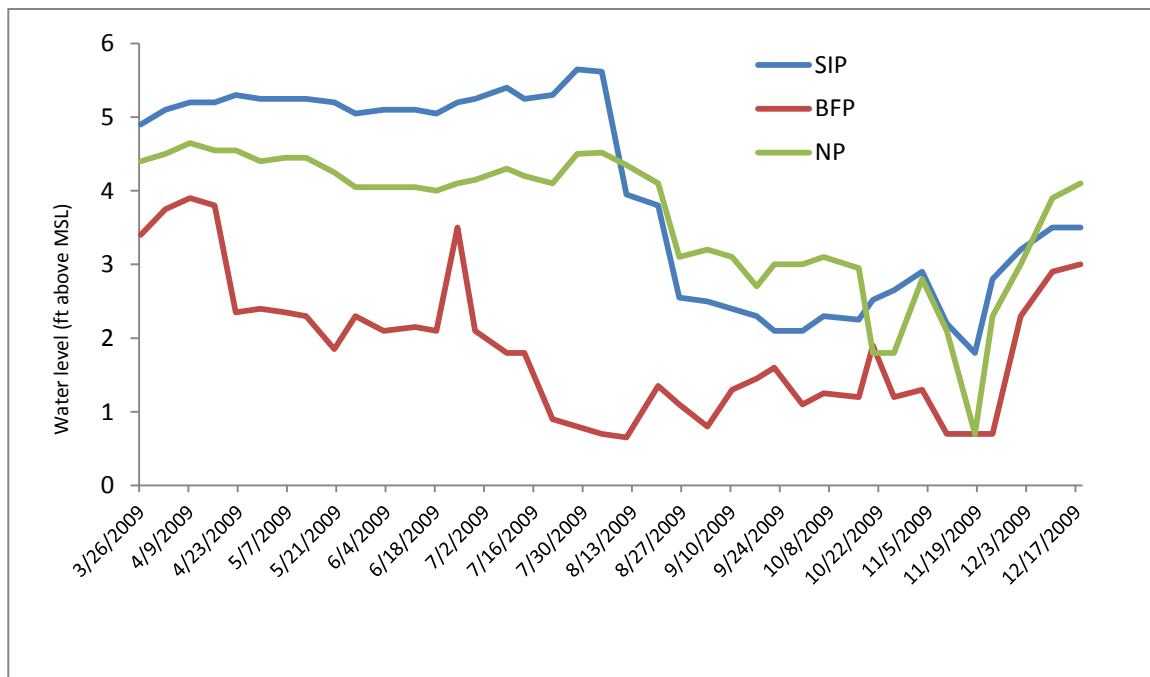


Figure 6. Water levels in the three impoundments through the 2009 field season. Bill Forward was drawn down for spring shorebird, and fall shorebird and waterfowl. Stage Island was drawn down in August for fall waterfowl, and North Pool was drawn down in October for mowing.

We also continued to remove mute swans attempting to nest in the impoundments. In 2009, our Law Enforcement officers removed x mute swans, Wildlife Services removed an additional x mute swans.

Avian Influenza Monitoring and Waterfowl Banding

From August 14th through October 29th, waterfowl were captured in three swim-in traps in the impoundments, two in the North Pool and one in Stage Island Pool. Target species

were tested for highly pathogenic avian influenza and samples were sent to the National Wildlife Health Center.

A total of 221 ducks were banded including 160 mallards, 11 American green-winged teal, 38 American black ducks, 3 gadwalls, and 1 mallard/black duck hybrid (Figure x). A total of 95 birds were recaptured 187 times. Of these recaptured individuals, 85 were local recaptures and 10 were foreign recaptures. We also banded 8 Canada geese that were inadvertently trapped. A total of 40 ducks were swabbed for avian influenza; all test results were negative for the H5 N1 strain of the virus though 4 ducks tested positive for other strains of avian influenza.

For detailed information about waterfowl banding and sampling in 2009, please see the Duck Banding Summary.

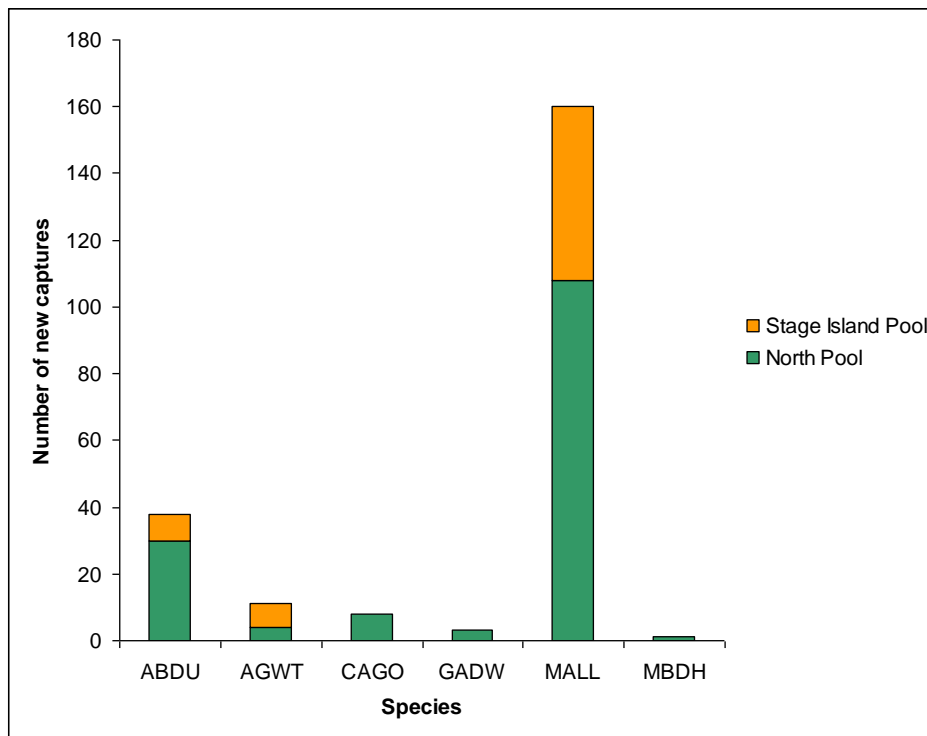


Figure x. Comparison of number of new captures by species for North Pool and Stage Island Pool (2009).

In collaboration with Biodiversity Research Institute (BRI), we live captured and collected oral-pharyngeal and cloacal swabs from 22 wintering waterfowl including common eiders and American black ducks (Table 1). Eiders were trapped using a floating mist-net set up and decoys while black ducks were trapped using baited walk-in traps. Walk-in traps were deployed and monitored by Massachusetts Division of Fisheries and Wildlife biologists. All 22 individual birds tested negative for HPAI. In addition to testing for HPAI, birds were also tested for total mercury content.

Table x. List of waterfowl species and number of birds sampled for HPAI, 2010.

Species	# Sampled
Common Eider	14
American Black Duck	8
Totals	22

Also in collaboration with BRI, we live captured and collected oral-pharyngeal and cloacal swabs from 15 migrating shorebirds in the fall of 2009 (Table x). Birds were trapped using 12 m mist-nets and/or drop nets with decoys set up on the mudflats in the foraging locations. All 15 individual birds tested negative for HPAI. In addition to testing for HPAI, birds were also tested for total mercury content.

Table x. Migrating live shorebirds sampled for HPAI, fall 2009.

Species	# Sampled
Dunlin	12
White-Rumped Sandpiper	1
Semipalmated Sandpiper	1
Semipalmated Plover	1
Totals	15

Habitat Response

Vegetation Surveys in Entire Impoundment

Vegetation surveys of Stage Island and Bill Forward Pools were conducted in October 2009. High water levels had been maintained throughout the growing season to drown *Phragmites* which had been sprayed and mowed in previous years. Because of the high water levels, all moist soil sampling plots in Stage Island Pool were submerged and not sampled.

The vegetation surveys found 14 plant species in each pool. Appendix A includes the complete list of plants found in the impoundments from 2004-2009. In Stage Island Pool, 16 of 27 robust vegetation survey plots were submerged in 1-34cm of water. The most abundant species along these transects include *Typha latifolia* (24%), *Phragmites australis* (17%) and *Echinochola* spp (15%). The overall species richness is lower than previous years, probably due to pool flooding. *Typha* frequency was higher and *Eliocharis* frequency lower than in previous years.

In the Bill Forward Pool, the most abundant plant species include *Atriplex patula* (77%), *Agrostis stolonifera* (77%) and *Pluchea purpurascens* (63%). These species were much more frequent than in past years. Bare ground was abundant (77%) due to maintaining high water levels through the growing season to suppress *Phragmites* growth.

Response of Resources of Concern

Waterbird Use

Peak waterbird use in both impoundments occurred during the fall shorebird migration (see Appendix B). Maximum bird use in Stage Island Pool occurred on September 3, with a total of 1,066 birds recorded. The peak bird use in Stage Island Pool occurred one month later in 2009 than 2008; furthermore, the maximum value in 2009 was lower by over 2,000 individuals than 2008. This decrease is likely due to the high water level maintained through August, which did not provide opportunity for germination of seed producing moist-soil plants, such as *Scirpus* and *Eleocharis*. Maximum bird use in Bill Forward Pool was observed on August 4, with a total of 1,334 birds recorded. The date and abundance value observed for Bill Forward Pool in 2009 was similar to 2008.

Shorebirds were the most numerous guild using the impoundments. Peak shorebird use was recorded in the Bill Forward Pool on August 4, with a total of 1,426 individuals consisting primarily of semipalmated plovers and sanderlings. In Stage Island Pool, peak shorebird abundance occurred on August 26, with a total of 840 individuals dominated by semipalmated plovers, semipalmated sandpipers, and sanderlings. Waterfowl was the second most numerous guild using the impoundments. Peak waterfowl use was recorded on October 6 in Bill Forward Pool, with a total of 223 individuals dominated by Canada geese. Peak waterfowl abundance in Stage Island Pool was observed on September 3, with a total of 740 individuals dominated by mallards (Figure 13). Wading bird use peaked on September 22 in Stage Island Pool, with a total of 76 individuals primarily consisting of snowy egrets. Wading bird use in Bill Forward Pool was very minimal throughout the year.

2010: Management Strategy Prescriptions

- Continue to manage Bill Forward and Stage Island Pools for migrating waterfowl and shorebirds, with spring and fall shorebird drawdown for Bill Forward and Fall shorebird drawdown for Stage Island.

BFP: Spring Shorebird Migration Drawdown

- Maintain full pool during winter months (until March)
- Starting early March, drawdown water levels (1.8') over a 6-8 week period such that shallow water (<10 inches) and mudflats are maximized at peak spring shorebird migration (late April).
- Maintain low water levels (2.3') through mid June to encourage germination of moist-soil plants and invertebrate population growth.
- Starting June 25, draw water level down to 1.8' (7/10) for fall shorebird migration.
- Maintain low water until 9/15
- Slowly flood up impoundment to maximize optimal water level (2.5') for dabbling ducks (12-18 inches) in later September and diving ducks (>24 inches, 3.5') in late October.
- Flood water level to full pool (4.0') prior to freeze date.

SIP: Fall Shorebird Migration Drawdown

- Maintain full pool during winter and spring months (until April).
- Starting mid June, drawdown water level (1.5'-2.0') during a 6-8 week period such that shallow water (<10 inches) and mudflats are maximized at peak shorebird migration (July 25).
- Maintain low water (1.0') through August to encourage germination of moist-soil plants and growth of invertebrate population.
- Starting early September, start slow flooding of impoundment for fall waterfowl migration. Maximize optimal water level (2.5') for dabbling ducks (12-18 inches) in mid September and optimal water level (3.0'-3.5') for diving ducks (> 24 inches) in mid October.
- Flood water level to full pool (5.0') prior to freeze date.
- Install staff gauges in relation to mean sea level at the North Pool water control structure.
- Continue to manage the North Pool to benefit breeding wading birds and waterfowl by maintaining high water levels through the breeding season (April – August).
- Conduct 1 marsh and wading bird survey in all impoundments with suitable habitat.
- Monitor plant response to water level management using established vegetation plots in North Pool, Bill Forward and Stage Island Pool according to 1994 monitoring protocols.
- Continue to band fall migratory waterfowl and conduct surveillance for avian influenza.
- Manage the robust vegetation area against invasive plants (i.e. Phragmites, purple loosestrife) and promote a mix of native wetland plants (e.g. cattail, asters, beggars tick) in Stage Island and Bill Forward Pools.
 - Using water level manipulation, and if necessary spot herbicide and mowing, to manage against Phragmites and cattail.

G. Thacher Island

Habitat Objective

By 2015, restore a colony of common and roseate terns to Thacher Island NWR by creating gull-free zones on the Refuge portion of the Island, removing predators, and providing optimal breeding habitat in an area not susceptible to storm surges.

2008 Management Prescriptions

On June 8, 2009 Parker River NWR staff visited Thacher Island NWR to census Greater Black-backed Gull and Herring Gull eggs. Viable eggs were poked to render them non-viable. The weather was overcast and approximately 65° F. Five staff members completed a full survey of the island in 4 hours.

Staff poked 614 Greater Black-backed Gull eggs in 227 nests. 13 chicks were observed. 25 eggs were not poked due to inaccessibility or because they were hatching. 2149 Herring Gull eggs were poked in 775 nests. 9 chicks were observed and 10 eggs were not poked. Cormorant nests and a Common Eider nest were also noted on the trip.

A second trip to Thacher Island was cancelled due to rain and poor weather conditions. The follow up trip could not be scheduled due to the Thacher Island Association's booked boat schedule.

Habitat Response

N/A

Response of Resources of Concern

The gull population at Thacher Island appears to have been steady or declining since we started the population control program in 2002.

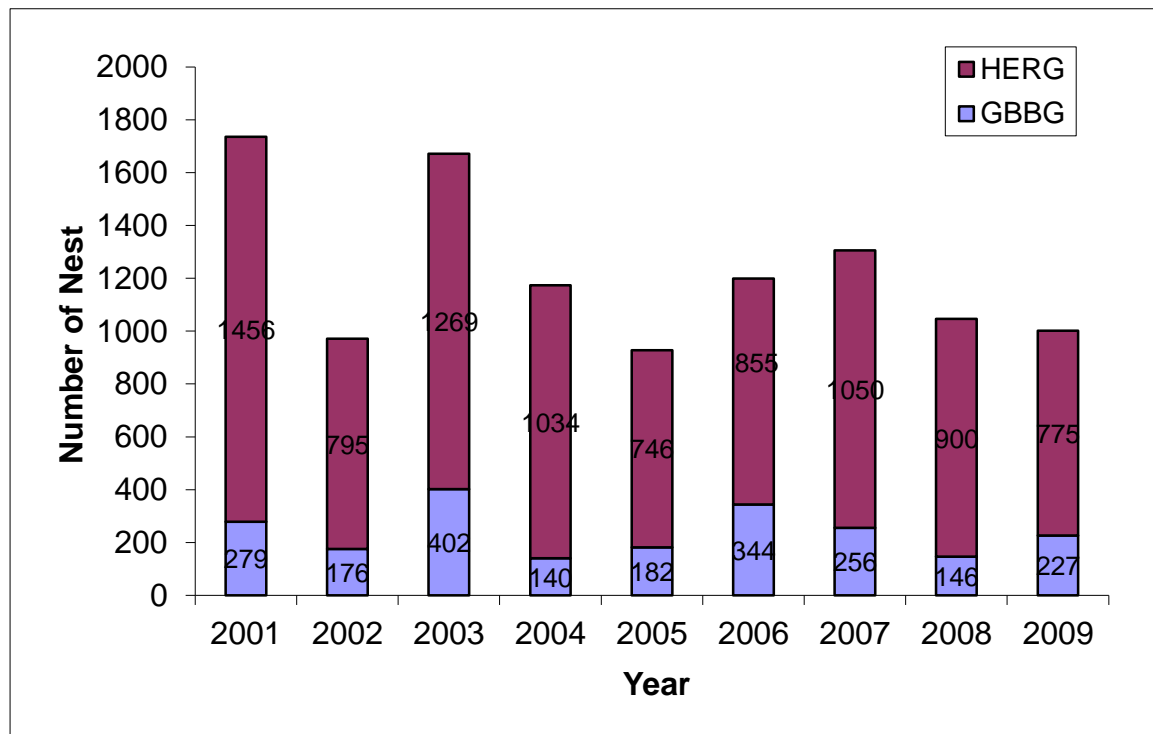


Figure 8. Breeding gull census at Thacher Island. No eggs were punctured in 2001 or 2006.

2009: Management Strategy Prescriptions

- Conduct breeding gull census in late May and poke or addle all eggs found.
Conduct follow-up survey in mid June to monitor success of addling efforts.

Appendix A Summary of Vegetation Survey in the Impoundments

Table A-1. Frequency of occurrence and percent abundance of plant species found in the robust vegetation area of the Stage Island Pool from 2004 to 2009. Vegetation surveys were not conducted in 2008.

Species	2009	2007	2006	2005	2004
<i>Agrostis stolonifera</i>	2.17			4.74	1.00
<i>Atriplex patula</i>	8.70			0.32	0.02
Bare Ground	52.17		33.67	15.80	21.45
<i>Bidens connata</i>	10.87	6.16	0.02	1.27	1.52
<i>Calystegia sepium</i>		0.11	0.13	0.32	0.20
<i>Chenopodium rubra</i>		1.01	0.80	0.03	
<i>Cyperus esculentus</i>				0.14	
<i>Cyperus filicinus</i>		0.07		0.46	
<i>Echinochloa</i> spp.	15.22				
<i>Eleocharis parvula</i>	6.52	27.22	0.02	0.27	0.02
<i>Erechtites hieracifolia</i>	4.35	1.53	0.62	3.67	0.12
<i>Gallium</i> species	4.35	0.11	0.34	0.70	0.62
<i>Hypericum</i> species		0.18		0.49	
<i>Impatiens capensis</i>				0.14	
<i>Juncus canadensis</i>		0.04	0.04	0.46	0.18
<i>Lythrum salicaria</i>	8.70	1.46	1.13	3.40	3.97
<i>Panicum dichotoflorum</i>		2.77	8.95	34.35	
<i>Panicum</i> sp.				6.20	0.02
<i>Parthenocissus quinquefolia</i>				0.03	
<i>Phragmites australis</i>	17.39	22.53	17.43	30.41	13.76
<i>Polygonum</i> sp.			0.06	0.92	0.02
<i>Rumex</i> sp.			0.13	1.65	0.36
<i>Scirpus americanus</i>	4.35		0.34		0.73
<i>Scirpus maritimus</i>	6.52		4.42	3.92	
<i>Scirpus pungens</i>	2.17	0.33		0.89	
<i>Spartina pectinata</i>	6.52	0.18		2.87	1.48
<i>Toxidendron radicans</i>			0.02		0.15
<i>Typha latifolia</i>	23.91	4.17	6.80	8.91	8.39
Water	54.35		21.06		8.55
Wrack			0.84		22.65
Species Richness	14	25	19	27	23

Table A-2. Frequency of occurrence and percent abundance of plant species found in the Stage Island Pool, Moist Soil area from 2004 to 2007. Vegetation surveys were not conducted in the Moist Soil area in 2008 or 2009.

Species	2007	2005	2004
Agrostis stolonifera	3.82	2.10	0.08
Atriplex patula	0.08		0.25
Bare Ground	18.29	35.73	16.33
Bidens connata	3.05	1.23	2.10
Carex sp.			2.10
Chenopodium rubrum	1.97	0.08	
Cyperus esculentus	0.15		
Cyperus filicinus		6.72	
Cyperus strigosus		0.08	
Eleocharis parvula	30.88	8.62	
Erechtites hieracifolia	5.44	1.15	0.62
Galium tinctorium	0.15		0.53
Juncus sp.	1.15		0.08
Lythrum salicaria	1.76	2.58	1.15
Panicum dichotoflorum	3.58	10.87	
Panicum sp.		2.33	
Panicum virgatum			
Scirpus maritimus	0.38	0.70	1.23
Scirpus pungens/americanus	4.52	1.77	
Spartina alterniflora			
Spartina pectinada		3.27	
Spergularia maritima		0.62	
Phragmites australis	7.62	1.52	16.25
P. australis (dead)		4.05	
Typha sp.	14.44	17.63	32.32
Water	16.83	9.80	3.27
Species Richness	26	22	17

Table A-3. Frequency of occurrence and percent abundance of plant species found in the Bill Forward Pool from 2004 to 2009. Vegetation surveys were not conducted in 2008.

Species	2009	2007	2006	2005	2004
Agrostis stolonifera	63.33	30.53	11.14	30.00	13.48
Aster subulatus	36.67	2.85	3.36		
Aster tenuifolius			7.07		0.62
Atriplex patula	76.67	1.42	0.48	0.17	0.17
Bare Ground	76.67	7.80	2.45	16.27	
Bidens Conata		2.60	19.83	1.80	4.10
Calystegia sepium			0.36	2.43	1.85
Carex straminea			0.12	1.23	
Chenopodium rubra		1.77	0.48		
Convulvus arvensis			0.12		
Cyperus filicinus		0.08	0.12		
Cyperus strigosus			1.45	0.53	
Dodder					0.17
Echinochloa sp.		0.42	0.24		
Eleocharis parvula	30.00	20.95	4.07	29.13	19.30
Epilobium cilatum			0.74		
Erechtites heiracifolia		0.50	0.6	1.60	1.73
Erogostis sp.			0.86		
Gallium tinctorium		0.17	11.79		0.62
Hordeum jubatum			0.12	1.80	
Juncus canadensis	3.33		0.12	0.08	
Juncus gerardii				0.62	
Lycopus americanus		0.08	0.36	0.08	
Lythrum Salicaria	23.33	19.08	19.86	5.63	34.35
Panicum dichotoflorum		3.78	11.8	1.88	
Panicum virgatum					2.18
Parthenocissus quinquefolia					0.53
Phragmites australis	23.33	12.25	7.5	11.05	16.63
Pluchea purpensus	43.33	2.77	5.9	0.17	1.12
Polygonum spp			0.73		0.33
Polygonum punctatum			1.48		
Rumex sp.	3.33	0.08	0.12	0.70	0.08
Rumex verticillatus			0.12		
Sentaria geniculata	3.33				
Schoenoplectus maritimus			2.5	0.53	4.80
Schoenoplectus pungens		2.68		1.88	6.38
Schoenoplectus sp.		10.68	2.5	2.41	11.18
Scirpus acutus			0.98		
Scirpus pungens	6.67				
Scirpus validus					0.08
Solidago sempervirens				0.17	
Spergularia marina	6.67				
Symphotrichum subulatum					1.43
Toxicodendron radicans					2.87
Typha spp.		5.12	5.05	6.12	9.63
Water	10			13.60	24.13

Species richness	12	24	35	22	28
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Appendix B
Waterbird Use in the Impoundments in 2007

Table x. Average bird use from bird surveys conducted from March through December.

Species	Stage Island	Bill Forward	Salt Pannes
Canada Goose	10.67	55.78	0.00
Mute Swan	9.00	0.33	0.00
Wood Duck	1.00	0.00	0.00
American Wigeon	0.00	0.67	0.00
Gadwall	19.67	11.67	8.67
American Black Duck	25.00	21.67	0.50
Mallard	203.11	53.22	27.83
Northern Shoveler	9.00	0.11	0.00
Northern Pintail	63.44	5.67	0.00
Green-winged Teal	195.33	49.11	0.17
Blue-winged Teal	0.00	0.11	0.00
Ring-necked Duck	0.11	0.00	0.00
Lesser Scaup	3.33	0.89	0.00
Bufflehead	12.00	3.56	0.00
Red-breasted Merganser	0.11	1.78	0.00
Hooded Merganser	0.00	2.67	0.00
Ruddy Duck	0.44	0.00	0.00
Pied-billed Grebe	0.00	0.11	0.00
Double-crested Cormorant	41.56	5.89	0.67
Great Blue Heron	2.00	1.00	0.00
Great Egret	13.11	0.56	1.17
Snowy Egret	17.00	5.33	1.33
Green Heron	0.11	0.00	0.00
Black-crowned Night-Heron	0.11	0.00	0.00
Black-bellied Plover	0.89	109.33	0.00
American Golden-Plover	0.22	0.00	0.00
Semipalmated Plover	87.22	350.44	20.83
Killdeer	1.78	0.33	1.00
Spotted Sandpiper	0.11	1.11	0.00
Greater Yellowlegs	0.11	0.00	1.17
Willet	0.11	1.00	2.17
Lesser Yellowlegs	13.56	15.11	0.50
Sanderling	106.33	260.56	0.00
Semipalmated Sandpiper	140.78	96.11	121.00
Least Sandpiper	2.22	1.22	1.00
White-rumped Sandpiper	1.56	0.00	6.83
Pectoral Sandpiper	0.11	0.11	0.00
Stilt Sandpiper	0.00	0.11	0.00

Dunlin	2.56	86.22	0.00
Short-billed Dowitcher	1.00	29.44	7.67
Long-billed Dowitcher	0.00	0.11	0.00
Whimbrel	0.00	0.22	0.00
Hudsonian Godwit	0.00	0.11	0.00
Marbled Godwit	0.00	0.11	0.00
Common Tern	0.00	0.22	1.67
Least Tern	0.00	0.00	0.17
Ring-billed Gull	0.00	13.67	0.00
Great Black-backed Gull	0.00	0.56	0.00
Herring Gull	0.00	1.22	0.00
Ring-billed Gull	0.00	0.44	0.00
European Starling	0.00	24.44	0.00